

early event in the angiogenic response that liberates cells for subsequent mobilization. In the present study, both PA and LPA weakly induced the chemotactic migration of endothelial cells from an established monolayer. The chemotactic response induced by PA and LPA was similar in intensity to that observed with optimal levels of the known protein endothelial cell chemoattractants, basic fibroblast growth factor (bFGF) and vascular endothelial growth factor (VEGF). A markedly greater chemotactic response was effected by nanomolar concentrations of S1P, indicating that this platelet-derived factor plays an important role in a key aspect of angiogenesis, chemotactic migration of endothelial cells. The chemotactic response to S1P was completely inhibited by preincubation of endothelial cells with **antisense** oligonucleotides to the high-affinity S1P receptor, **Edg-1**. In addition, chemotaxis of endothelial cells to S1P was inhibited by preincubation of cells with specific inhibitors of tyrosine kinases, but inhibitors of phosphatidylinositol 3' kinase had little effect. Finally, LPA effectively stabilized endothelial monolayer barrier function, a late event in angiogenesis. Thus, the phospholipid growth factors, PA, S1P, and LPA, display divergent and potent effects on angiogenic properties of endothelial cells and angiogenic differentiation of endothelial cells potentially act in tandem to effectively induce neovascularization. These mediators may thus exert important roles in restoration of hematopoiesis, as they facilitate blood vessel formation at sites of transplanted stem cells, allowing the progeny of engrafted progenitors to move from marrow sinusoids to the peripheral vasculature.

2/3,AB/9 (Item 9 from file: 155)

DIALOG(R) File 155: MEDLINE(R)

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10336813 99282821 PMID: 10354366

Lysophospholipid enhancement of human T cell sensitivity to diphtheria toxin by increased expression of heparin-binding epidermal growth factor.

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Proceedings of the Association of American Physicians (UNITED STATES)

May-Jun 1999, 111 (3) p259-69, ISSN 1081-650X Journal Code: CDQ

Contract/Grant No.: HL31809, HL, NHLBI

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

The effects of lysophosphatidic acid (LPA) and sphingosine 1-phosphate (S1P) on T cell expression of heparin-binding epidermal growth factor-like growth factor (HB-EGF), the diphtheria toxin (DT) receptor, were investigated in the Tsup-1 cultured line of human CD4+ 8+ 3low T lymphoblastoma cells. Tsup-1 cells bear endothelial differentiation gene (**edg**-2 and -4 encoded G protein-coupled receptors (GPCRs) for LPA and **Edg**-3 and -5 GPCRs for S1P. Suppression by DT of Tsup-1 cell protein synthesis was enhanced by LPA and S1P, with lipid structural specificity similar to that required for their recognition by **Edg** receptors. LPA and S1P increased the Tsup-1 cell level of immunoreactive HB-EGF, and neutralizing antibodies to HB-EGF inhibited LPA and S1P enhancement of Tsup-1 cell susceptibility to DT. Stabilized transfection of Tsup-1 cells with a combination of plasmids encoding **Edg**-2 plus -4 **antisense** mRNA suppressed the levels of **Edg**-2 and -4, but not **Edg**-3 and -5, in Western blots and reduced in parallel the increments in HB-EGF and susceptibility to DT evoked by LPA but not S1P. Similar transfection with **Edg**-3 plus -5 **antisense** plasmids suppressed Tsup-1 cell levels of immunoreactive **Edg**-3 and -5, but not **Edg**-2 or -4, and

2/3,AB/10 (Item 10 from file: 155)  
DIALOG(R) File 155: MEDLINE(R)  
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10078834 99138900 PMID: 9973477

Lysophosphatidic acid and sphingosine 1-phosphate protection of T cells from apoptosis in association with suppression of Bax.

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Journal of immunology (UNITED STATES) Feb 15 1999, 162 (4) p2049-56,  
ISSN 0022-1767 Journal Code: IFB

Contract/Grant No.: HL31809, HL, NHLBI

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

Members of a subfamily of G protein-coupled receptors (GPCRs), encoded by five different endothelial differentiation genes (edgs), specifically mediate effects of lysophosphatidic acid (LPA) and sphingosine 1-phosphate (S1P) on cellular proliferation and differentiation. Mechanisms of suppression of apoptosis by LPA and S1P were studied in the Tsup-1 cultured line of human T lymphoblastoma cells, which express **Edg**-2 and **Edg**-4 GPCRs for LPA and **Edg**-3 and **Edg**-5 GPCRs for S1P. At 10<sup>-10</sup> M to 10<sup>-7</sup> M, both LPA and S1P protected Tsup-1 cells from apoptosis induced by Abs to Fas, CD2, and CD3 plus CD28 in combination. Apoptosis elicited by C6 ceramide was inhibited by S1P, but not by LPA, in part because ceramide suppressed expression of **Edg**-2 and **Edg**-4 surface receptors for LPA without affecting **Edg**-3 surface receptors for S1P. At 10<sup>-9</sup> M to 10<sup>-7</sup> M, LPA and S1P significantly suppressed cellular levels of the apoptosis-promoting protein Bax, without altering the levels of Bcl-xL or Bcl-2 assessed by Western blots and immunoassays. Transfections of pairs of antisense plasmids for **Edg**-2 plus **Edg**-4 and **Edg**-3 plus **Edg**-5, and hygromycin selection of transfecants with reduced expression of the respective **Edg** R proteins in Western blots, inhibited both protection from apoptosis and reduction in cellular levels of Bax by LPA and S1P. Thus, LPA and S1P protection from apoptosis is mediated by distinct **Edg** GPCRs and may involve novel effects on Bax regulatory protein.

2/3,AB/11 (Item 11 from file: 155)

DIALOG(R) File 155: MEDLINE(R)  
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09589639 97459772 PMID: 9315732

The immediate-early gene product MAD-3/**EDG**-3/IkappaB alpha is an endogenous modulator of fibroblast growth factor-1 (FGF-1) dependent human endothelial cell growth.

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FERS letters (NETHERLANDS) Sep 8 1997, 414 (2) p419-24, ISSN 0014-5793 Journal Code: EUH

Contract/Grant No.: DK45659, DK, NIDDK; HL35627, HL, NHLBI; HL49094, HL, NHLBI

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

The tumor promoter phorbol 12-myristate 13-acetate inhibits the growth of

inhibit its expression. The **antisense** I $\kappa$ B $\alpha$  PTO-treated cells exhibited an exaggerated growth response to fibroblast growth factor-1 (FGF-1). In contrast, IL-1-induced growth arrest response was not modulated. These data suggest that the early response gene I $\kappa$ B $\alpha$  is an endogenous regulator of endothelial cell growth in vitro.

2/3,AB/12 (Item 1 from file: 5)  
DIALOG(R) File 5:Biosis Previews(R)  
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11126343 BIOSIS NO.: 199799747488  
The immediate-early gene product MAD-3/**EDG**-3/I-kappa-B-alpha is an endogenous modulator of fibroblast growth factor-1 (FGF-1) dependent human endothelial cell growth.

AUTHOR: Hla Timothy(a); Zimrin Ann B; Evans Mark; Ballas Karin; Maciag Thomas

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JOURNAL: FEBS Letters 414 (2):p419-424 1997

ISSN: 0014-5793

RECORD TYPE: Abstract

LANGUAGE: English

ABSTRACT: The tumor promoter phorbol 12-myristic 13-acetate inhibits the growth of human endothelial cells and induces the formation of capillary-like, tubular structures. We report the novel growth regulatory function of the immediate-early gene, **edg**-3, which is identical to the I-kappa-B-alpha/MAD-3 gene. We employed phosphothioate oligonucleotides (PTO) directed against the translation initiation site of I-kappa-B-alpha to inhibit its expression. The **antisense** I-kappa-B-alpha PTO-treated cells exhibited an exaggerated growth response to fibroblast growth factor-1 (FGF-1). In contrast, IL-1-induced growth arrest response was not modulated. These data suggest that the early response gene I-kappa-B-alpha is an endogenous regulator of endothelial cell growth in vitro.

? s edg and (antisens? or ribozym?)

406 EDG  
29214 ANTISENS?  
5111 RIBOZYM?  
S1 19 EDG AND (ANTISENS? OR RIBOZYM?)

? rd

...completed examining records  
S2 12 RD (unique items)  
? t s2/3,ab/all

2/3,AB/1 (Item 1 from file: 155)  
DIALOG(R)File 155:MEDLINE(R)

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11306555 21192228 PMID: 11150298

Sphingosine 1-phosphate-induced endothelial cell migration requires the expression of **EDG-1** and **EDG-3** receptors and Rho-dependent activation of alpha vbeta3- and betal-containing integrins.

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Journal of biological chemistry (United States) Apr 13 2001, 276 (15)  
p11830-7, ISSN 0021-9258 Journal Code: HIV  
Contract/Grant No.: DK-45659, DK, NIDDK

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

Sphingosine 1-phosphate (SPP), a platelet-derived bioactive lysophospholipid, is a regulator of angiogenesis. However, molecular mechanisms involved in SPP-induced angiogenic responses are not fully defined. Here we report the molecular mechanisms involved in SPP-induced human umbilical vein endothelial cell (HUVEC) adhesion and migration. SPP-induced HUVEC migration is potently inhibited by **antisense phosphothioate oligonucleotides** against **EDG-1** as well as **EDG-3** receptors. In addition, C3 exotoxin blocked SPP-induced cell attachment, spreading and migration on fibronectin-, vitronectin- and Matrigel-coated surfaces, suggesting that endothelial differentiation gene receptor signaling via the Rho pathway is critical for SPP-induced cell migration. Indeed, SPP induced Rho activation in an adherence-independent manner, whereas Rac activation was dispensable for cell attachment and focal contact formation. Interestingly, both **EDG-1** and **-3** receptors were required for Rho activation. Since integrins are critical for cell adhesion, migration, and angiogenesis, we examined the effects of blocking antibodies against alpha(v)beta(3), beta(1), or beta(3) integrins. SPP induced Rho-dependent integrin clustering into focal contact sites, which was essential for cell adhesion, spreading and migration. Blockage of alpha(v)beta(3)- or beta(1)-containing integrins inhibited SPP-induced HUVEC migration. Together our results suggest that endothelial differentiation gene receptor-mediated Rho signaling is required for the migration of human umbilical vein endothelial cells as well as beta(1)-containing

11306526 21192199 PMID: 11152468

Endothelial differentiation gene-2 receptor is involved in lysophosphatidic acid-dependent control of 3T3F442A preadipocyte proliferation and spreading.

Pages C; Daviaud D; An S; Krief S; Lafontan M; Valet P; Saulnier-Blache JS

INSERM U317, Institut Louis Bugnard, Universite Paul Sabatier, CHU Rangueil, Batiment L3, 31403, Toulouse cedex 04, France.

Journal of biological chemistry (United States) Apr 13 2001, 276 (15)

p11599-605, ISSN 0021-9258 Journal Code: HIV

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

**EDG-2**, **EDG-4**, **EDG -7**, and **PSP24** genes encode distinct lysophosphatidic acid (LPA) receptors. The aim of the present study was to determine which receptor subtype is involved in the biological responses generated by LPA in preadipocytes. Growing 3T3F442A preadipocytes express **EDG-2** and **EDG-4** mRNAs, with no expression of **EDG-7** or **PSP24** mRNAs. Quantitative reverse transcriptase-polymerase chain reaction revealed that **EDG-2** transcripts were 10-fold more abundant than that of **EDG-4**. To determine the involvement of the **EDG-2** receptor in the responses of growing preadipocytes to LPA, stable transfection of **antisense EDG -2** cDNA was performed in growing 3T3F442A preadipocytes. This procedure, led to a significant and specific reduction in **EDG -2** mRNA and protein. This was associated with a significant alteration in the effect of LPA on both cell proliferation and cell spreading. Finally, the differentiation of growing preadipocytes into quiescent adipocytes led to a strong reduction in the level of **EDG-2** transcripts. Results demonstrate the significant contribution of the **EDG -2** receptor in the biological responses generated by LPA in 3T3F442A preadipocytes.

2/3,AB/3 (Item 3 from file: 155)

DIALOG(R) File 155: MEDLINE(R)

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11305893 21179099 PMID: 11134047

Sphingosine 1-phosphate protects human umbilical vein endothelial cells from serum-deprived apoptosis by nitric oxide production.

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Journal of biological chemistry (United States) Apr 6/2001, 276 (14)

p12627-34, ISSN 0021-9258 Journal Code: HIV

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

Sphingosine 1-phosphate (S1P) can prevent endothelial cell apoptosis. We investigated the molecular mechanisms and signaling pathways by which S1P protects endothelial cells from serum deprivation-induced apoptosis. We show here that human umbilical vein endothelial cells (HUVECs) undergo apoptosis associated with increased DEVDase activity, caspase-3 activation, cytochrome c release, and DNA fragmentation after 34 h of serum deprivation. These apoptotic markers were suppressed by the addition of S1P. The NO donor S-nitroso-N-acetylpenicillamine also inhibited apoptosis.

enhancing Ca(2+)-sensitivity. NOS activity without changes in the eNOS protein level. S1P-mediated cell survival and NO production were suppressed significantly by pretreatment with **antisense** oligonucleotide of **EDG-1** and partially by **EDG-3 antisense**. S1P-mediated NO production was suppressed by the addition of pertussis toxin, an inhibitor of G(i) proteins, the specific inhibitor of phospholipase C (PLC), and the Ca(2+) chelator BAPTA-AM. These findings indicate that S1P protects HUVECs from apoptosis through the activation of eNOS activity mainly through an **EDG-1** and -3/G(i)/PLC/Ca(2+) signaling pathway.

2/3,AB/4 (Item 4 from file: 155)  
DIALOG(R) File 155: MEDLINE(R)  
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11273181 21226767 PMID: 11278944

Two novel Xenopus homologs of mammalian LP(A1)/**EDG-2** function as lysophosphatidic acid receptors in Xenopus oocytes and mammalian cells.  
Kimura Y; Schmitt A; Fukushima N; Ishii I; Kimura H; Nebreda AR; Chun J  
Department of Pharmacology, School of Medicine, University of California,  
San Diego, La Jolla, California 92093-0636, USA.

Journal of biological chemistry (United States) May 4 2001, 276 (18)  
p15208-15, ISSN 0021-9258 Journal Code: HIV

Languages: ENGLISH

Document type: Journal Article

Record type: In Process

Lysophosphatidic acid (LPA) induces diverse biological responses in many types of cells and tissues by activating its specific G protein-coupled receptors (GPCRs). Previously, three cognate LPA GPCRs (LP(A1)/VZG-1/**EDG-2**, LP(A2)/**EDG-4**, and LP(A3)/**EDG-7**) were identified in mammals. By contrast, an unrelated GPCR, PSP24, was reported to be a high affinity LPA receptor in Xenopus laevis oocytes, raising the possibility that Xenopus uses a very different form of LPA signaling. Toward addressing this issue, we report two novel Xenopus genes, xlp(A1)-1 and xlp(A1)-2, encoding LP(A1) homologs (approximately 90% amino acid sequence identity with mammalian LP(A1)). Both xlp(A1)-1 and xlp(A1)-2 are expressed in oocytes and the nervous system. Overexpression of either gene in oocytes potentiated LPA-induced oscillatory chloride ion currents through a pertussis toxin-insensitive pathway. Injection of **antisense** oligonucleotides designed to inhibit xlp(A1)-1 and xlp(A1)-2 expression in oocytes eliminated their endogenous response to LPA. Furthermore, retrovirus-mediated heterologous expression of xlp(A1)-1 or xlp(A1)-2 in B103 rat neuroblastoma cells that are unresponsive to LPA conferred LPA-induced cell rounding and adenylyl cyclase inhibition. These results indicate that XLP(A1)-1 and XLP(A1)-2 are functional Xenopus LPA receptors and demonstrate the evolutionary conservation of LPA signaling over a range of vertebrate phylogeny.

2/3,AB/5 (Item 5 from file: 155)  
DIALOG(R) File 155: MEDLINE(R)  
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11197951 21103260 PMID: 11160288

Lysophosphatidic acid receptor-selective effects on Jurkat T cell migration through a Matrigel model basement membrane.

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Journal of immunology (United States) Feb 15 2001, 166 (4) p2317-22.

Lysophosphatidic acid (LPA) and sphingosine 1-phosphate (S1P) from platelets and mononuclear phagocytes mediate T cell functions through endothelial differentiation gene-encoded G protein-coupled receptors (**Edg** Rs) specific for LPA (**Edg**-2, -4, and -7) or S1P (**Edg**-1, -3, -5, -6, and -8). Jurkat leukemic T cells with the SV40 virus large T Ag (Jurkat-T cells) express **Edg**-3>-2>-4 Rs, as assessed by RT-semiquantitative PCR and Western blots with anti-**Edg** R mAbs. Jurkat-T cells expressing predominantly **Edg**-2 R (Jurkat-T-2 cells) and **Edg**-4 R (Jurkat-T-4 cells) were developed by cotransfection with the respective sense plasmids and a mixture of **antisense** plasmids for the other **Edg** Rs, and hygromycin selection. Migration of Jurkat-T-4 cells, but not Jurkat-T-2 cells, through a layer of Matrigel on a 5-um pore polycarbonate filter was stimulated up to 5-fold by 10(-9) to 10(-6) M LPA and by 30-300 ng/ml of anti-**Edg**-4 R Ab, but not anti-**Edg**-2 R Ab. LPA and anti-**Edg**-4 R Ab also enhanced by up to 4-fold the expression of matrix metalloproteinase by Jurkat-T-4 cells, but not Jurkat-T-2 cells, as assessed by cleavage of [(3)H]-type IV human collagen in the Matrigel. Enhancement of matrix metalloproteinase-dependent trans-Matrigel migration of Jurkat-T cells by the chemokine PANTES was suppressed by anti-**Edg**-2 R Abs, but was stimulated by anti-**Edg**-4 R Abs. The opposite effects of **Edg**-2 and **Edg**-4 LPA receptors on trans-Matrigel migration and some other T cell functions provide receptor-selective mechanisms for regulation of T cell recruitment and immune contributions.

2/3,AB/6 (Item 6 from file: 155)  
DIALOG(R) File 155: MEDLINE(R)  
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10825768 20428454 PMID: 10971577

Expression and characterization of **Edg**-1 receptors in rat cardiomyocytes: calcium deregulation in response to sphingosine 1-phosphate.

Nakajima N; Cavalli AL; Biral D; Glembotski CC; McDonough PM; Ho PD; Betto R; Sandona D; Palade PT; Dettbarn CA; Klepper RE; Sabbadini RA

Department of Biology and Heart Institute, San Diego State University, CA 92182-4614, USA.

European journal of biochemistry (GERMANY) Sep 2000, 267 (18) p5679-86, ISSN 0014-2956 Journal Code: EMZ

Contract/Grant No.: HL 63975, HL, NHLBI; NS/HL 25037, NS, NINDS

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

Recent evidence indicates that sphingolipids are produced by the heart during hypoxic stress and by blood platelets during thrombus formation. It is therefore possible that sphingolipids may influence heart cell function by interacting with G-protein-coupled receptors of the **Edg** family. In the present study, it was found that sphingosine 1-phosphate (SphIP), the prototypical ligand for **Edg** receptors, produced calcium overload in rat cardiomyocytes. The cDNA for **Edg**-1 was cloned from rat cardiomyocytes and, when transfected in an **antisense** orientation, effectively blocked **Edg**-1 protein expression and reduced the SphIP-mediated calcium deregulation. Taken together, these results demonstrate that cardiomyocytes express an extracellular lipid-sensitive receptor system that can respond to sphingolipid mediators. Because the major source of SphIP is from blood platelets, we speculate that **Edg**-mediated SphIP negative inotropic and cardiotoxic effects may play important roles in acute myocardial ischemia where SphIP levels are probably elevated in response to thrombus.

10781532 20428654 PM 10849424

Lipid phosphate phosphatase-1 and Ca<sup>2+</sup> control lysophosphatidate signaling through **EDG-2** receptors.

Xu J; Love LM; Singh I; Zhang QX; Dewald J; Wang DA; Fischer DJ; Tigyi G; Berthiaume LG; Waggoner DW; Brindley DN

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Journal of biological chemistry (UNITED STATES) Sep 8 2000, 275 (36) p27520-30, ISSN 0021-9258 Journal Code: HIV

Contract/Grant No.: HL 61459, HL, NHLBI; R01 61751, PHS

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

The serum-derived phospholipid growth factor, lysophosphatidate (LPA), activates cells through the **EDG** family of G protein-coupled receptors. The present study investigated mechanisms by which dephosphorylation of exogenous LPA by lipid phosphate phosphatase-1 (LPP-1) controls cell signaling. Overexpressing LPP-1 decreased the net specific cell association of LPA with Rat2 fibroblasts by approximately 50% at 37 degrees C when less than 10% of LPA was dephosphorylated. This attenuated cell activation as indicated by diminished responses, including cAMP, Ca(2+), activation of phospholipase D and ERK, DNA synthesis, and cell division. Conversely, decreasing LPP-1 expression increased net LPA association, ERK stimulation, and DNA synthesis. Whereas changing LPP-1 expression did not alter the apparent K(d) and B(max) for LPA binding at 4 degrees C, increasing Ca(2+) from 0 to 50 micrometer increased the K(d) from 40 to 900 nm. Decreasing extracellular Ca(2+) from 1.8 mm to 10 micrometer increased LPA binding by 20-fold, shifting the threshold for ERK activation to the nanomolar range. Hence the Ca(2+) dependence of the apparent K(d) values explains the long-standing discrepancy of why micromolar LPA is often needed to activate cells at physiological Ca(2+) levels. In addition, the work demonstrates that LPP-1 can regulate specific LPA association with cells without significantly depleting bulk LPA concentrations in the extracellular medium. This identifies a novel mechanism for controlling **EDG-2** receptor activation.

2/3,AB/8 (Item 8 from file: 155)

DIALOG(R)File 155: MEDLINE(R)

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10475226 20108368 PMID: 10645770

Induction of endothelial cell chemotaxis by sphingosine 1-phosphate and stabilization of endothelial monolayer barrier function by lysophosphatidic acid, potential mediators of hematopoietic angiogenesis.

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Journal of hematotherapy & stem cell research (UNITED STATES) Dec 1998,

v. (6) p627-34, ISSN 1525-8165 Journal Code: DJX

Contract/Grant No.: P01 HL 50864, HL, NHLBI; R01 61751, PHS

Languages: ENGLISH

Document type: Journal Article

Record type: Completed

Angiogenesis, the formation of new blood vessels, is an important component of restoration of hematopoiesis after BMT, but the mediators involved in hematopoietic angiogenesis have not been identified. We